

INVESTIGATOR'S ANNUAL REPORT

National Park Service

All or some of the information provided may be available to the public

Reporting Year: 2002	Park: Shenandoah NP
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Permit#: SHEN-1999-SCI-0001	
Park-assigned Study Id. #: SHEN-00192	
Project Title: IMPLICATIONS OF CATCHMENT STRUCTURE FOR A TIME-VARYING HYDROLOGICAL AND HYDROCHEMICAL RESPONSE IN A FORESTED HEADWATER CATCHMENT	
Permit Start Date: Sep 01, 1999	Permit Expiration Date Aug 31, 2002
Study Start Date: Sep 01, 1999	Study End Date Aug 31, 2002
Study Status: Completed	
Activity Type: Research	
Subject/Discipline: Water / Hydrology	
Objectives: Develop a theoretical framework for quantifying transient, topographically driven water movement and reactive mass transport in the subsurface of headwater catchments	
Findings and Status: <p>Work focused on determining critical controls on concentration-discharge (c-Q) dynamics. The relationship between concentration (c) and discharge (Q) in a stream is one of the aspects of hydrochemical catchment response that has been used widely as a diagnostic. In particular, loops in the c-Q curve, commonly referred to as hysteresis loops, are used to infer particular mixing patterns. At the South Fork of Brokenback Run in the Shenandoah National Park (SNP), Virginia, measurements indicate that stream response is due to a shallow stormwater flow path in addition to groundwater and saturation-excess overland flow. The hydrological response can be modeled using a modification of TOPMODEL to account for the shallow subsurface stormflow zone. The hydrochemical response can then be modeled by linking the hydrological response with mixing model. The model shows hysteresis in the c-Q relationship in the anticlockwise (AW) direction whereas the measured relationship between dissolved silica and stream discharge exhibits hysteresis in the clockwise (CW) direction. We have elucidated several possibilities to explain the discrepancy. We showed that observed CW and AW loops might be explained by time variability in soil-water concentrations. We also showed that variations in component hydrograph timing and of riparian-zone mixing can influence results and that different events are observed to produce different directions of c-Q loops. The project supported the MS work of Todd Scanlon and the ongoing Ph.D. work of Jeff Chanat under this aspect of the project.</p> <p>Work on the relationship between soil CO₂ and stream alkalinity was also explored as part of the project. Stream water chemical composition is tightly coupled to the concentration of CO₂ in soil air. However, little is known about the inorganic C cycle in soils. We used a series of simple physically-based models that simulate soil temperature, soil tension, soil CO₂ processes, and soil chemistry. We then simulated the spatial and temporal dynamics</p>	

of soil CO2 concentrations throughout the SFBR catchment. Despite some model deficiencies, we reasonably simulate the gross overall patterns through space and time of soil air CO2 concentration. During the growing season when soil temperature is high, soil water status is the limiting control on soil respiration and CO2 concentration. Soil CO2 concentration can be high despite low respiration values because of changing diffusivity of the soils with moisture content. The project supported the Ph.D. dissertation of Danny Welsch under this aspect of the project.

For this study, were one or more specimens collected and removed from the park but not destroyed during analyses?

No

Funding provided this reporting year by NPS:

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Funding provided this reporting year by other sources:

206000

Fill out the following ONLY IF the National Park Service supported this project in this reporting year by providing money to a university or college

Full name of college or university:

n/a

Annual funding provided by NPS to university or college this reporting year:

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